6.9 Port Madison/Sinclair Inlet

A. Assessment

In this section we assess salmon and bull trout use, food web and ecological condition, landscape condition, and threats.

1. Salmon Use

Chinook

This is part of the Central and South Sound region, which includes six independent populations in the Cedar-Lake Washington, Green, Puyallup, and Nisqually river systems but none from the streams draining directly to this sub-basin.

a) Juvenile

- Juvenile Chinook salmon from neighboring populations (e.g., central Puget Sound sub-basin) utilize this sub-basin for feeding and growth, refuge, physiological transition and as a migratory corridor (juvenile salmon functions). See Figure 3-1 for a list of all Chinook populations. This sub-basin provides direct support to meeting the Chinook ESU criteria by supporting rearing of juveniles of many populations from all five geographic regions of origin, but is likely most importantly for populations from the geographic region it lies within, and adjacent geographic regions of origin.

b) Adult

- Sub-adult and adult salmon from neighboring populations utilize habitats within this sub-basin as a passage corridor and grazing area. This sub-basin provides direct support to meeting the Chinook ESU criteria by supporting rearing of sub adults of many populations from all five geographic regions of origin, but is likely most importantly for populations from the geographic region it lies within, and adjacent geographic regions of origin.

Other Listed Species (not comprehensively reviewed or assessed for this sub-basin)

- Chum salmon: Populations of the Hood Canal/Eastern Strait of Juan de Fuca Summer Chum ESU do not emanate from this sub-basin. It is not known if these populations use this sub-basin
- Bull trout (anadromous): Preliminary core populations within the Puget Sound Management Unit of bull trout do not exist in this sub-basin. It is not known if any anadromous bull trout use this sub-basin.

2. Ecological and Landscape Conditions

<u>Food Web, Ecological Conditions</u>

The Port Madison/Sinclair Inlet sub-basin contains industrialized regions in Dyes Inlet and Sinclair Inlet, and some of the region is experiencing rapid growth. Port Madison supports a

herring stock and Dyes Inlet supports a smaller stock, both important prey resource for non-natal Chinook populations.

Overall area

- Total area (deep-water plus nearshore) is 17,728 acres (27.7 square miles), the smallest of all 11 sub-basins
- Deep-water portion (marine waters landscape class) comprises 4,416 acres (6.9 square miles), or 25% of the total sub-basin area.

Nearshore area

- Nearshore portion comprises 13,376 acres (20.9 square miles), or 75% of the total sub-basin area.
- Nearshore area within this sub-basin is 3% of the nearshore area of the entire Puget Sound basin.
- Contains 96 miles of shoreline (beaches landscape class).
- The "key" bays (landscape class) identified in this sub-basin is Liberty Bay, Fletcher Bay, Dyes Inlet, and Sinclair Inlet.
- Fifteen linear miles (16%) of the shoreline is designated as marine riparian (defined as the estimated area of length overhanging the intertidal zone).
- In this sub-basin, 16% of the shoreline (15 linear miles) has eelgrass (*Zostera marina* and *Z. japonica*); may be patchy or continuous.
- In this sub-basin, floating kelp does not occur. In this sub-basin, 18% of the shoreline (17 linear miles) has non-floating kelp; may be patchy or continuous.

Landscape Conditions

Landscape conditions for this sub-basin are depicted in Figures E-8.1 through 8.3 and E-9.4 of Appendix E.

Pocket Estuary Analysis

We identified 39 pocket estuaries in this sub-basin. This sub-basin contains the greatest concentration of pocket estuaries in Puget Sound (1.86 per square mile). Seventeen of the 39 pocket estuaries are located in the Dyes Inlet region, with the remaining pocket estuaries distributed across the landscape in a relatively even distribution.

- Freshwater sources were observed in greater than two-thirds of the pocket estuaries,
- Based on the assumptions listed in Appendix B, all three of the Chinook functions (feeding, osmoregulation and refuge) were estimated to occur in 24 of the 39 pocket estuaries. Most of the remaining pocket estuaries were estimated to have two of the three Chinook functions,
- Six pocket estuaries were estimated to be *properly functioning*. Seven pocket estuaries were estimated to be *not properly functioning*. The remaining pocket estuaries were recorded as *at risk*.

Drift Cell Analysis

The drift cell characterization developed for this sub-basin is presented in Appendix E, Figure E-8.5 (Main Basin) and subsequent text. Recommendations for protection and restoration are highlighted in Tables 6-18 and 6-19.

Threats/stressors

Loss and/or simplification of delta and delta wetlands

Natal estuaries for Chinook salmon do not occur in this sub-basin. No information is presented for smaller, non-natal deltas and delta wetlands.

Alteration of flows through major rivers

Larger-scale flow alterations are not present in this sub-basin. Smaller dams and diversions likely exist but are not identified here.

Modification of shorelines by armoring, overwater structures and loss of riparian vegetation/LWD

The projected population growth in Kitsap County between 2000-2025 is 43% (99, 602 people) (PSAT 2004). In this sub-basin, shoreline armoring occurs along 56 miles (59%) of the shoreline. Over 31 miles of shoreline are classified as 100% armored. Over 17 miles are classified as 0% armored. The total number of overwater structures is 2,383, consisting of ramps (98), piers and docks (256), small slips (1,936) and large slips (93). Overwater structures are observed in greater concentrations where armoring occurs. Within 300 feet of shore railroad grades occur along 2.6 miles, along a section of heavily armored shoreline in the southern portion of Sinclair Inlet.

Contamination of nearshore and marine resources

Regions with 15% or greater impervious surface are concentrated in Dyes Inlet and Sinclair Inlet, as well as Liberty Bay (PSAT 2004). Sediment samples analyzed from 1997-1999 reveal the majority of observed sediment contamination was located in urban waters such as Sinclair Inlet (PSWQAT 2002a). Over all years for which samples were collected and analyzed, Sinclair Inlet had higher levels of metals (copper, lead, mercury, silver, zinc) than any other location sampled in Puget Sound.

Figure E-8.3 illustrates the distribution of water quality impairments in this sub-basin.

Alteration of biological populations and communities

Stations sampled as part of the Ecology/NOAA 1997-1999 evaluation of sediment quality exhibited impaired invertebrate communities in Sinclair Inlet and Dyes Inlet (PSWQAT 2002a).

There are approximately 8 hatcheries releasing various species of salmonids into the Port Madison/Sinclair Inlet sub-basin, which may affect community structure at certain times of the year. Because of poor water quality, there are no commercial shellfish aquaculture operations in the sub-basin, however, there are several floating net pen aquaculture facilities. Overharvest of fisheries species in the past, continued recreational fishing pressure, loss of critical habitats and poor water quality have potentially greatly altered biological populations and communities within the sub-basin but comparative studies with other sub-basins in Puget Sound have not been conducted. Specific hatchery reform recommendations for this region have been formulated by the Hatchery Scientific Review Group available at the following websites.
http://www.lltk.org/pdf/HSRG_Recommendations_February_2002.pdf
http://www.lltk.org/pdf/HSRG_Recommendations_March_2003.pdf

Transformation of land cover and hydrologic function of small marine drainages via urbanization

Despite the small size of this sub-basin, we identified more pocket estuaries here than in the entire main basin of Puget Sound. Only 5 of the 39 pocket estuaries analyzed were determined to not be properly functioning for juvenile Chinook, largely due to urbanization impacts. Seven additional pocket estuaries are at risk of losing significant functions due to urbanization and many shoreline areas and watersheds are still rapidly urbanizing within the sub-basin. See Figure E-9.4 – list of pocket estuaries and noted stressors from visual observation via oblique aerial photos.

Transformation of habitat types and features via colonization by invasive plants

Spartina spp is not found in this sub-basin. 9% of the shoreline (9 miles) contains *Sargassum muticum*, which may be patchy or continuous.

B. Evaluation

In this section we list goals and evaluate the level of realized function for natal and non-natal Chinook, summer chum, and bull trout. From this we then list each of the proposed protection and restoration actions for this sub-basin, and describe the benefits to natal Chinook, non-natal Chinook, and summer chum and bull trout (if any).

Goals for listed salmon and bull trout whose natal streams are in this sub-basin

a) Provide early marine support for independent spawning aggregations, such as fish from streams such as Gorst Creek.

Goals for listed salmon and bull trout whose natal streams are outside this sub-basin

a) Provide support for all neighboring Puget Sound Chinook salmon populations.
b) Maintain and/or increase forage fish production as prey for non-natal salmon populations
c) Provide spatial structure and diversity support for populations of Chinook salmon from within the main basin (e.g., central Puget Sound sub-basin).

Realized function for listed salmon and bull trout

Fry migrant Chinook – Some of the fish emanating from streams such as Gorst Creek may adopt this life history strategy and rely on shallow, protected habitats in the vicinity of their natal estuaries. Two-thirds of the pocket estuaries in this sub-basin are estimated to be "at risk" by one or more landscape stressors, though the opportunity exists to derive some function (feeding and growth, refuge, and/or physiological transition) from many of the pocket estuaries in this sub-basin should fry migrants from this or other sub-basins (e.g., central sound) reach the shoreline habitats (Figure E-9.2). The density of pocket estuaries in this sub-basin may contribute little to the viability of fry migrant Chinook in the Puget Sound ESU because the nearest independent populations are (1) fairly distant from this sub-basin's pocket estuary resources, and (2) not currently expressing significant fry migrant (or delta fry) trajectories.

Delta fry Chinook – Natal estuaries for independent populations of Chinook salmon are not present in this sub-basin. Delta fry may occur in fish emanating from streams such as Gorst Creek, but these small natal estuaries probably to not provide much habitat capacity.

Parr migrant Chinook – On average this life history type is the most abundant in Puget Sound. Parr migrants and yearlings from neighboring sub-basins are most likely to utilize available nearshore habitats of this sub-basin because these fish are larger and capable of surviving greater swimming distances from the natal estuaries in central and south Puget Sound. Connectivity between habitat types and landscape classes is critical to ensure successful exploitation of available habitats. Parr migrants will encounter heavily armored shorelines, at risk or not properly functioning pocket estuaries, sewage outfalls and chemical contamination throughout much of Sinclair Inlet. Conditions are similar, but improved slightly in Dye Inlet with the exception of some areas with depressed dissolved oxygen levels. Parr migrants will encounter generally improved conditions moving north through Port Orchard with the exception of Liberty Bay where temperature, chemicals and low dissolved oxygen are evident (Figure E-9.3). Finally, the Port Madison herring stock is an important forage fish for parr migrants.

Yearling Chinook –Connectivity between habitat types and landscape classes is very important to yearlings from central sound populations, and other populations moving about broadly within Puget Sound. Yearling migrants will be exposed to the same types of stressors and ramifications as described in the parr migrant section above. Yearling migrants can derive functions (e.g., foraging, refuge, migratory pathway) from available nearshore habitats. Forage fish from the Port Madison herring stock will be especially important to this life history type as yearlings from multiple Chinook populations migrate throughout Puget Sound.

Sub-adult and adult Chinook – Larger fish migrating through this sub-basin may need to contend with issues such as toxic contaminants in the food chain and sediment contamination. Researchers from WDFW have documented that, in general, Chinook salmon living in or migrating through Puget Sound (specifically in central and south sound) are more contaminated with PCBs than stocks outside of Puget Sound (e.g., Columbia River, WA coast). See Figure 4.7 in Section 4. Residence time in the central and southern Puget Sound basins is suspected as a "primary predictor of PCB concentration in Chinook salmon" and as such, those salmon spending the greatest amount of time in central and south sound exhibit the greatest PCB

concentrations (WDFW, unpublished data) (Figure 4-8). Another toxic contaminant of concern in Puget Sound is PBDEs, a common chemical that, like PCBs, are found in greater concentrations in resident Chinook salmon versus migratory Chinook salmon.

Listed summer chum – We hypothesize that Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon do not use this sub-basin.

Anadromous bull trout – We hypothesize that anadromous bull trout do not use this sub-basin.

Table 6-18. Recommended protection actions for Port Madison/Sinclair Inlet

Protection action	Benefit to Natal Chinook	Benefit to Other (non-natal) Chinook	Benefit to summer chum, bull trout, other fish
Aggressively protect all pocket estuaries regardless of their current function or proximity to natal deltas within the central Puget Sound sub-basin. (See Fig. E-9.4)	Support for weakly swimming migrants from systems such as Gorst Creek	Sustained feeding, growth, refuge and migration functions for all Puget Sound populations, especially from main Basin and Hood Canal	Sustained feeding, growth, refuge and migration functions other species
Protect water quality from further degradation	Support for small, sensitive fish from systems such as Gorst Creek	Sustained migration and reduced mortality for PS populations	Sustained migration and reduced mortality for other species
Protect against catastrophic events		Sustained migration and reduced mortality for PS populations	Sustained migration and reduced mortality for other species
Protect Port Madison (and the smaller Dyes Inlet) herring stock, as well as forage fish spawning grounds		Sustained feeding and growth for PS populations	Sustained feeding and growth for other species

Table 6-19. Recommended improvement actions for Port Madison/Sinclair Inlet

Improvement action	Benefit to Natal Chinook	Benefit to Other (non-natal) Chinook	Benefit to summer chum, bull trout, other fish
Consider wastewater reclamation and reuse for all current and planned new sewage discharges throughout the sub-basin	Improved support for small, sensitive fish from independent spawning aggregations (eg., Gorst Creek)	Improved migration and reduced mortality for PS populations	Improved migration and reduced mortality for other species
Add enhanced treatment for stormwater discharging directly to Puget Sound to the same standards as for salmon bearing streams	Improved support for small, sensitive fish from systems such as Gorst Creek	Improved migration and reduced mortality for PS populations	Improved migration and reduced mortality for other species
Encourage voluntary re-vegetation of cleared residential shorelines throughout the sub-basin. Put special emphasis on maintaining connectivity, primary production and water quality		Improved feeding, growth, refuge and migration functions for all Puget Sound populations, especially from main Basin and Hood Canal	Improved feeding, growth, refuge and migration functions other species
Restore drift cell function in Shoreline Restoration Target Area 9 (Main Basin Map Fig. E-8.5)		Improved feeding, growth, refuge and migration functions for all Puget Sound populations, especially from main Basin and Hood Canal	Improved feeding, growth, refuge and migration functions other species
Restore areas containing contaminated sediment hot spots and ongoing toxic discharges.		Improved migration and reduced mortality for PS populations	Improved migration and reduced mortality for other species
Reform hatchery practices		Improved feeding and growth	Improved feeding and growth of other species